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ABSTRACT

This qualitative study, investigating the claims, concerns, and issues arising within the design stages of problem-based learning (PBL) curriculum units, was conducted during two masters-level classes during the summer of 1999. A hermeneutic dialectic discourse among veteran teachers (who were novice PBL curriculum designers) was facilitated by the instructor of the course. The 17 participating teachers evinced an interest in implementing problem-based learning but indicated a desire for support during construction of the actual units. The study was undertaken to uncover impediments to quality in the PBL curriculum design process. Findings from the study data include the "quality" criteria incorporated into the rubrics for evaluating each design product (the meet the problem document, a curriculum alignment description, a sample know/need to know board, a sample problem statement, an anticipated problem map, a list of coaching questions, a resource list, a comparison of alternative solutions, a capstone performance description, an assessment instrument for the capstone performance, and a debriefing instrument) and the final Critiquing Guide designed by the stakeholders. Other conclusions within the study include such teacher perceptions as: confidence that teachers who had no previous training in PBL could create quality curriculum units; several design products had overlapping quality criteria; students in the class gained knowledge of rubric design; and these students were able to articulate reasons for implementing rubric design in their own classrooms. (Contains 11 references. Appended are rubrics and the Critiquing Guide.) (BT)

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Quality Problem-Based Learning Experiences for Students: Design Deliberations Among Teachers From Diverse Disciplines

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Abstract

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Quality Problem-Based Learning Experiences for Students: Design Deliberations Among Teachers From Diverse Disciplines

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QUALITY PROBLEM-BASED LEARNING EXPERIENCES FOR STUDENTS:
DESIGN DELIBERATIONS AMONG TEACHERS FROM DIVERSE DISCIPLINES

This qualitative study, investigating the claims, concerns, and issues arising within the design stages of problem-based learning (PBL) curriculum units, was conducted during two masters-level classes during the summer of 1999. A hermeneutic dialectic discourse among veteran teachers (who were novice PBL curriculum designers) was facilitated by the instructor of the course. The 17 participating teachers evinced an interest in implementing
problem-based learning, but indicated a desire for support during the construction of the actual units. The study was undertaken to uncover impediments to quality in the PBL curriculum design process.

A recent literature review yielded a wealth of material on problem-based learning. Further perusal, however, elicited the conclusion that current research is focusing on issues other than the design quality of the PBL experience. The three primary issues within the literature appear to be:

- Effects of PBL implementation on students,
- Descriptions of the utilization of PBL in various disciplines, and
- "How-to" monographs describing the process of PBL.

The following table showing selected research study titles within the recent literature document these themes:

Effects on Students	Utilization in a Discipline	"How to" (PBL process)
Problem-Based Learning: Effects on the Early Acquisition of Cognitive Skill in Medicine (Hmelo, 1998)	Problem-based Learning in Analytical Science Undergraduate Teaching (Shelton & Smith, 1998)	A Point System for Management of an Integrated Problem-based Learning Curriculum (Rundquist, Bergdahl, Sandstrom, & Hammar, 1998)
Investigating Student Interactions within a Problem-Based Learning Environment in Biology (Guerrera & Lajoie, 1998)	Problem-Based Learning in Counselor Education (Stewart, 1998)	Problems as Possibilities: Problem-Based Learning for K-12 Education (Torp & Sage, 1998)

The intent of this study, then, was to add to a body of knowledge not currently being expanded via research: that body of knowledge concerning the design of quality problem-based learning experiences.

Methodology

Participants and Setting

A focus group of 17 teachers interested in implementing problem-based learning (PBL) was recruited for two sections of a masters-level class on PBL during the 1999 summer session at North Carolina State University. As stated previously, the participants

in the study were veteran teachers, with experiences ranging from two to ten years, but novice PBL curriculum designers. The instructor of the course had received one week of training in the problem-based learning process and had subsequently implemented PBL as the sole method of instruction in an entire year-long high school biochemistry class. The university course was developed by this instructor, based upon lessons learned from this experience.

Within the PBL college course, class activities included not only constructing a PBL curriculum unit, but on setting design criteria for each piece and on critiquing the completed product. Therefore, students within the classes created rubrics (scoring guides) for judging each portion of the unit, from the meet-the-problem document to the debriefing session. The culminating activity of the course was the design of a critiquing instrument to use in assessing the quality of an entire PBL curriculum unit.

Two texts were utilized for this course. The first, Problems as Possibilities by Torp and Sage (1998, p. 3) explored the "possibilities of problem-based learning as a natural integrating focus for relevant curriculum and meaningful student learning." This text had a practical focus for teachers, showing how to implement PBL in the K-12 classroom. The second text, Implementing Problem Based Learning in Leadership Development by Bridges and Hallinger (1995) provided insight into the theory and process of PBL. Students in the class were required to read and critically review chapters from both texts.

Theoretical Framework and Design of the Study

This study was conceived within the constructivist epistemology, which emphasizes the need for students to interact socially in meaning-making activities. Tobin, Kahle, and Fraser (1990, p. 6) state this as, "Within the constructivist view, learning is defined as the acquisition of knowledge by individuals through a process of construction that occurs as sensory data are given meaning in terms of prior knowledge." Von Glaserfeld (1991) elaborates on this point and states that knowledge is always the result of a constructive activity and therefore cannot be transferred to a passive receiver. Therefore, the activities utilized within this research study (and in the PBL course) were framed with this view of learning (a social process in which students must actively participate in the airing and discussion of perceptions before these perceptions can be ratified, modified, or altered).

The research performed in this study was qualitative in nature. Qualitative research stresses "the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry" (Denzin & Lincoln, 1994, p. 4). Within the "socially constructed reality" of a masters-level classroom, the instructor collected anecdotal records and compiled contextual evidence in order to preserve the interplay of stakeholder interactions and classroom events. Such records ensure a "thick" data collection which can "provide as complete a data base as humanly possible in order to facilitate transferability judgments on the part of others who may wish to apply the study to their own situations" (Guba & Lincoln, 1989, p. 241). Within the PBL classroom discourse, a hermeneutic, dialectic process as described by Guba and Lincoln (1989) was utilized. Such a process brings to light the "claims, concerns, and issues" (Guba & Lincoln, 1989, p. 50) of the stakeholders involved in the investigation. In such a hermeneutic process, stakeholders are identified

and then interviewed, surveyed, sampled for opinions, asked to respond, etc. An important characteristic of this process is that data collection and data analysis are intertwined. As data are collected, they are immediately analyzed and then used to direct new data collection efforts. In this manner, the research relies heavily on the developing claims, concerns, and issues of the stakeholders, making the design of the study emergent.

Data Sources, Data Collection, and Data Analysis

Since investigation of interactions within the focus (stakeholder) groups was emphasized in this study, any classroom artifact which could reveal these interactions was important. Conversational interchanges among the stakeholders were captured on audio-tapes. Transcripts of these tapes provide a verbatim record of such conversations. These conversations reveal the thoughts of the novice PBL curriculum writers as they struggled to design the PBL unit and as they discussed quality criteria for each design product. Anecdotal records made by the primary investigator (the instructor) during and subsequent to class meetings also helped to capture exchanges and events. Such anecdotal records provide a window into the primary investigator's on-the-spot thinking while teaching the class. They reveal the original source of inferences and assertions later shared and checked with stakeholders.

The rubrics and the Critiquing Guide created by the teacher-stakeholders constitute another data source, as do the reflective journal entries compiled from these stakeholders. Additionally, "talkback" sheets were utilized at the end of the course to solicit stakeholder responses to specific questions concerning course topics. These four sources in particular show the criteria considered for each design product, capture decisions made about the relative importance of each criterion, and record the perceived impediments to quality construction of the PBL units. A comparison of the rubrics which were originally constructed for each design product and the criteria present on the Critiquing Guide constructed at the end of the class demonstrate the growth in sophistication of the stakeholders. The reflective journal entries and the responses of the participants to the "talkback" sheet questions helped the primary investigator both formulate and check assertions.

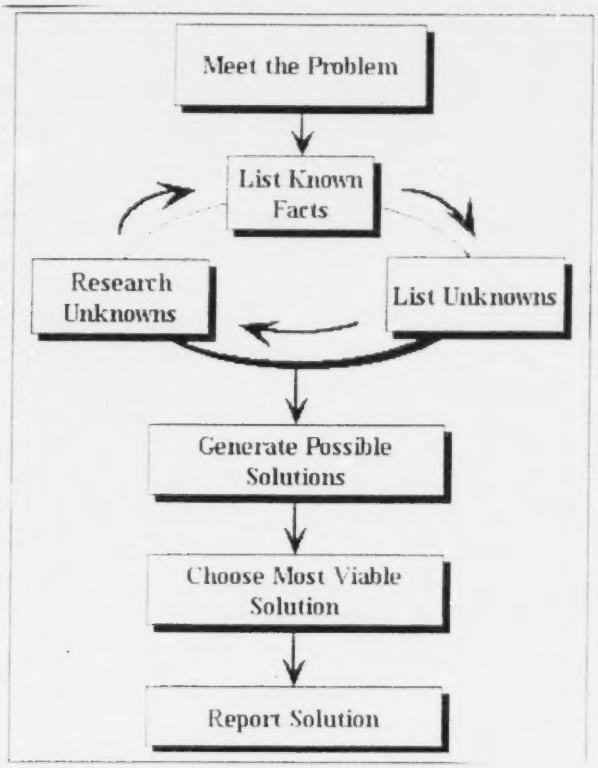
Evaluation results and the instruments of evaluation for the course must also be included in the list of evidence for findings. The instruments of evaluation were, of course, the rubrics created by the stakeholders for each design product. Evaluation results were given both orally and in writing and included both peer- and instructor-assessment of design work. In addition, the instructor kept records of the number of times each design product was submitted, as products were returned for further work if all criteria on the stakeholder-designed rubric for the product were not addressed.

From all these sources, the primary investigator formulated assertions and then utilized the hermeneutic dialectic process to check these assertions by sharing them with the stakeholders. In this manner, throughout the study, data collection, analysis, and interpretation were continuous and cyclic.

The Process of Problem-Based Learning

In brief, the steps in the PBL process begin with a problem. This problem is presented to students in the "meet-the-problem" documentation. The problem becomes

more defined as students separate known facts about the problem topic from unknown issues and capture their thoughts on a "know/need to know" board. A problem statement or research question is then written. Data collection to illuminate unknowns begins and group analysis of these data are now incorporated into the process. After several cycles of data collection and analysis, possible solutions to the problem are formulated. The potential solutions are examined in the light of all the evidence collected and the most viable solution is then selected. The PBL experience culminates with the public sharing of the solution and some type of evaluation. This evaluation may be formal or informal; self-, peer-, or instructor-assessed; written or oral.



First Thoughts: Original Rubrics for Each Design Product

By the end of this PBL masters-level course, students were eventually required to create eleven design products for their PBL curriculum units. These eleven products with brief descriptions of each were:

1. Meet the problem document—For the purposes of this class, the masters-level students decided the format for their first problem would be a written document of some sort (rather than as a video, role-playing exercise, visual representation, etc.).
2. Curriculum alignment description—This piece contains a brief description of the targeted audience (age, typical attributes, and developmental level of the students who will work on the problem).
3. Sample know/need to know board—Here, teachers create a list of "knowns" and a list of "unknowns" in order to anticipate the lists students will make. This exercise helps

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the teacher define her expectations and plan coaching questions to elicit inclusion of "expected" items, if students do not spontaneously volunteer them.

4. Sample problem statement—The sample problem statement, like the sample know/need to know boards help the teacher establish the intended curriculum to be addressed by the problem. Then, if students do not proceed along pathways the teacher hopes will be explored, coaching questions can be formulated to help them uncover such pathways.
5. Anticipated problem map—The map helps the teacher visualize the different parts of the problem, and how concepts are related or how they may overlap.
6. List of coaching questions—Coaching questions are written for the major student activities within the problem (meet the problem, know/need to know board, problem statement, research, and generation of solutions). Coaching questions are prompts for student thinking at cognitive, metacognitive, and epistemic levels (See Appendix A, Product Six for definitions of these terms).
7. Resource list—Here, the teacher makes a list of resources available for student use in the local school. The teacher also determines that these resources are adequate and developmentally appropriate.
8. Comparison of two alternative solutions—Quality problems are ones which have more than one right answer. The teacher must believe this to be true, in order to prevent "leading" the students to one particular solutions. Therefore, before presenting a problem to students, the teacher should create at least two different acceptable solutions to the problem.
9. Capstone performance description—The capstone performance is usually the one in which students share their solutions to the problem with the class or with outside evaluators.
10. Assessment instrument for evaluating the capstone performance—The teacher must plan ahead to develop criteria for this capstone performance and should ensure that the capstone performance is authentic to the problem (the way information would be shared in the "real world" if students were working there, instead of in a school).
11. Debriefing instrument—This instrument is designed to encourage evaluation of alternative solutions proposed by different student groups. The intent is that the class will create "one best solution" from all the disparate ones reported by the student groups in their capstone performances.

All but two of these design products were listed in the original syllabus of the course. The two which were added later were ones suggested by the masters-level teachers in the PBL class during class discussions within the course. These two design products were the curriculum alignment piece and the resource list. The circumstances which led to the inclusion of the curriculum alignment piece are covered in detail later in this paper. The resource list was added after one teacher returned to her school and consulted the media center there for information relevant to her problem. When she found very little information, she was disconcerted and concerned that the problem might not be "do-able" (as she put it), at her school. Bringing this to the attention of the class, she suggested that in a quality problem, the teacher would already know which resources would be available to students (and not have this come as a complete surprise). In this manner, if very few reference materials could be accessed at the school, the teacher could make arrangements

to import resources from another source. Therefore, the class thought it was important to add a resource list as another required design product.

For each of the eleven products, student input was sought in creating the rubric (scoring guide) used to evaluate each product. Before class discussions about these rubrics, students read pertinent material from the two course texts. They also participated in two rubric design experiences. The first such experience involved creating a rubric for cleaning a house. The second experience, called "The Camping Trip," asked students to evaluate student work on a math word problem. This word problem involved figuring out how much water campers should carry for a three-day camping trip. Ten samples of student work were distributed and the teachers in the class then separated the samples into 3 piles by the quality of the responses ("good, better, best;" "the good, the bad, and the ugly;" "good, fair, poor;" etc.) They were then asked to brainstorm criteria for a rubric to grade the student work samples.

From their text readings, the teachers gleaned descriptions of the design products and were able to articulate parameters recommended in the literature for inclusion in a particular product.. From the rubric design experiences, the teachers in the class practiced articulating quality criteria for use in scoring guides.

At this point, the teachers were ready to design their first rubric for the problem-based learning unit. For each design product, they first listed criteria which should be included. These criteria were captured as a checklist on the chalkboard. Then, students in the class were asked to prioritize the criteria by level of importance and to designate this level of importance with a point score.

This process was used repetitively to create rubrics for all eleven design products. The original rubrics generated by this process for each of the eleven products can be found in Appendix A. These rubrics show the criteria that the students felt needed to be present in each product to ensure quality of the design. It is clearly impossible, within the scope of this paper, to capture all the interactions and discussions that occurred in the design of all eleven products. However, the development of the rubric for the first product (meet-the-problem document) will be discussed in detail. Then, the original rubric will be compared with the Critiquing Guide, which was developed later in the course.

Rubric for the Meet the Problem Document

When the students were asked to generate criteria for this design product, several descriptors were quickly proffered by the class. These included:

- Authentic
- Motivating
- Real world
- Interdisciplinary
- Contains roles
- Ill-structured

Since this was the first rubric designed by the class, the instructor

asked students to define each of the terms more completely, in order to assure that the expectations were clear. For instance, the instructor asked, "How is 'authentic' different from 'real world'?"

John replied that "real world means the problem would actually happen, but authentic means that the way we present it is how it would be presented in real life." Ellen expanded on this to explain that "authentic has more to do with the format of the presentation, but 'real world' means it's believable – that people would actually be faced by this problem and would have to solve it."

At this point, the instructor stated, "It seems that these two words, 'authentic' and 'real world,' then, are not so much the criteria we need, but are descriptors of the criteria. For example, Ellen used the word 'format.' Is 'authentic' a descriptor associated with 'format'?" This instructor-generated question fueled the following interchange:

> Alan: Yeah, I think format is the criteria and "authentic" is just one portion of the format, like it should be appropriate.
> Instructor: The format or the authentic?
> Alan: I mean, the format should be authentic and appropriate to the problem.
> Chris: Like, in the real world, if we would get a memo from our boss, telling us to work on a problem, then for us to make the meet the problem document a memo is OK. It would be stupid to create a video for a problem we'd normally get as a memo.

The class discussion continued, until the students had decided to use "format" as a criterion and "authentic" and "appropriate to the problem" as descriptors of this criterion. Later, Carol, a language arts teacher, suggested that we should incorporate grammar into the format criterion, if we were truly defining excellence. Group discussion here resulted in the words, "uses standard writing practices" being added to the descriptors of the format category.

The discussion then moved to the "real world" descriptor. There were several suggestions for a category name which would include this descriptor. After discarding such terms as "qualities of the problem" (which the class felt would be confusing, as we were attempting to design "quality" criteria) and "problem needs" (which also was thrown out as "confusing"), the class settled on "problem characteristics" as the name of the second category of criteria. A coaching question from the instructor, "So, what else, besides 'real world' should be included in this category?" began the long exchange captured here:

> Sandy: I think "ill-structured" [from the original checklist] goes there.
> Anna: Me, too. "Ill-structured" describes the problem.
> Instructor: I know that "ill-structured" is a term used in your Torp & Sage book. What does this mean?
> Anna: It means the problem is messy, that it's complex, so it's hard to know how to tackle it.
> Lois: Yeah. It's all over the place and it's hard to solve.

Instructor: OK, so if we want the problem to be all these things, what are some words we can use to describe what we want? Should we use ill-structured? Will people outside this class know what this means?
Patricia: I don't think so. I know the first time I read this, I thought "ill-structured" was bad. I mean, it sounds like something that's "ill-structured" is not well-written, so it's bad.
Sandy: Me, too. I thought Torp & Sage were saying ill-structured was NOT the way to make the problem. I had to read it again to understand that we WANT "ill-structured."
Instructor: So, if we had trouble understanding "ill-structured," what else can we use in its place?
Lois: How about interdisciplinary? "Ill-structured" problems are messy like we said, which means they're full of; they've got more than one subject in them.
Alan: Yeah, interdisciplinary. A good problem won't just be about science, or just about math, or just about economics, it'll blend lots of different subject areas.
Instructor: OK, interdisciplinary [writes this on the board]. OK, what else?
John: I think Anna and Lois were onto something about the problem being hard to solve. If we write a good problem, the answer won't be obvious.
Carol: Obvious, I like that. The book says that the problem ought to be one that hasn't been solved before. So, if it hasn't been solved before, there's no way it could be obvious.
Instructor: Help me phrase this, then, Carol.
Carol: OK. How about "no obvious solution path?"
[Instructor writes this on the board]
Marsha: That's not enough, though. I've seen lots of math problems that seemed like they had no "obvious solution path" to me, but the teacher didn't agree with my answer, anyway! [Class laughs]
Instructor: Thanks, Marsha. That brings up another point. What about the answer to the problem?
Patricia: There should be more than one. Like, it should be open-ended.
Ellen: It's like that video you showed us where the teacher said "There's more than one way to skin a cat!" There ought to be multiple answers to the problem, not just one.
Chris: Yeah, let's put "no one right answer." That way, we'll set up a problem that we won't be *expecting* a certain answer to.
[Instructor adds this to the list on the board]
Instructor: OK. So far, we have 3 ideas listed under the "Problem Characteristics" category: "real world," "interdisciplinary," and "no one right answer." Are there others we should include?
Carol: I don't like "real world." The others are more descriptive and that's more a noun. Can we say "reality-based" instead?
[Noting general nods of consensus, the instructor makes the change]
Instructor: OK, but what else should we have? [No volunteers answer] If you are having trouble deciding, why don't you get out your meet the problem document for the mosquito problem [a practice problem done by the entire class earlier] and see if we've captured all the characteristics you see there.

John: Hey, I know. It has a deadline. Don't we need a deadline in every problem?

After some further discussion, the class decided to incorporate a deadline into the "problem characteristics" category. The discussion then moved to the roles of the student. At first, the inclusion of student roles was discussed within the "problem characteristics" category. However, several students suggested that this was important enough to be a stand-alone category. The discussion of the "student roles" culminated with the articulation of this description: "Present, role is one of stakeholder who in real world would work on problem." This was taken to mean that student roles had to be present in the meet the problem document, and that, like the problem presentation, the roles should be authentic (appropriate) to the problem. Alan put it like this: "Yeah, you wouldn't see a clown in an office, but you'd probably see an accountant. So, if your problem happened in an office, an accountant's OK, but not a clown."

After creating the "format," "problem characteristics" and "student roles" categories of criteria and writing descriptors for each, the students were ready to terminate the discussion. However, a question from Sandy fueled a new round of interactions:

Sandy: You know what worries me? It's that story you [the instructor] told us about your radiation problem. About how the teachers thought it was a great idea and they were all interested in it, but when the students got the problem, they could have cared less. What if that happens with our problems? How can we know if the students will be interested or not?
Instructor: Good point, Sandy. What do you [the class] think?
Ellen: I remember that video you showed us of *Dead Poets Society*. How Robin William's class was different from the other ones the boys went to on the first day.
John: Yeah. All the other teachers kept them in the classrooms, but Robin Williams took them to the trophy case.
Instructor: So, should we incorporate "change of location" into our rubric for the meet the problem document?
Patricia: No, that might be too hard. Not everyone can change their class if they want. Besides, that's not the only way to make things interesting for students.
Instructor: What other ways can you think of, Patricia?
Patricia: I think it wasn't that Robin Williams changed the location; I think it was just that he did something *different*.
Instructor: So, "different" is interesting?
Marsha: Yeah, I think so. It's like something you're not expecting, so you're surprised and that makes you interested.
Anna: It's the novelty of it—that's what keeps you interested.
Instructor: OK, novelty. [writes this on board] Anything else?
John: That thing you're not expecting. The unexpectedness of it.
Instructor: "Unexpectedness" – is that a word?
Sandy: How about "discrepant event?"

[Instructor adds this beside "novelty."
Instructor: Now, where am I putting these? Are these more problem characteristics?
Chris: No, let's make a separate category, to show how important this is. We could call it "motivational criteria."
John: Yeah, let's add it there.
Instructor: Are these enough descriptors of motivational? Are there any more we should add?

The discussion continued, with some students suggesting adding "relevance to the real world" into the motivational category. They felt that real world problems would be more motivating to students. However, other students felt that this was adequately covered in the "problem characteristics" category, so was not needed in the "motivational" category. It came down to a class vote with the majority voting to put "relevance to the real world" into the motivational category, yet keep "reality-based" in the "problem characteristics" category. The discussion then continued as to whether all three descriptors must be present to make a "quality" meet the problem document. Consensus was reached by students on a suggestion that 2 of the 3 factors (novelty, discrepant event, and relevance) would be enough.

At this point, the rubric for the meet the problem document looked like this on the board:

Format	Authentic style, appropriate to problem, uses standard writing practices.
Problem Characteristics	Reality-based, no one right answer, inter disciplinary, contains deadline, lacks obvious solution path
Student Roles	Present, role is one of stakeholder who in real world would work on problem
Motivational	Contains 2 or more of the following characteristics: discrepant event, novelty, relevance to real world

The class ended for the day with this rubric on the board. Students were asked to write a Reflective Journal entry before leaving the classroom, however, and the instructor reviewed these entries before the next class. A comment made by Lois in her journal entry was brought before the students in the next class period. Lois wrote:

> Getting teachers to use PBL as a strategy in their classroom will be difficult because they feel pressured (because of the state assessment) to cover the curriculum. Teachers already view time as a hindrance when it comes to teaching. With ill structured problems taking weeks to complete, teachers must be convinced this approach leads to higher test scores. My ultimate goal is to

understand how to use PBL as a way to organize the curriculum that will alleviate anxieties with curriculum coverage.

The instructor used Lois' comments to introduce curriculum alignment of state standards to the problem into the class discussions. After several interchanges, the students decided that this piece was so important they should create another design product to address this issue rather than adding it to the meet the problem product. These discussions eventually led to the development of the rubric for the curriculum alignment design product found in Appendix A, Product Two.

Thinking about the curriculum and what the problem could teach however, brought the students to add one final descriptor to the "problem characteristics" category of the rubric for the meet the problem document. After several iterations, the final wording which was added was "contains focal points for knowledge acquisition." Anna explained this addition as, "A quality problem has to lead the students to seek answers. If it doesn't, there's no use in introducing it at all!"

At this point, students were satisfied that all important quality criteria had been included in their rubric for the meet the problem product. The instructor then asked students to prioritize the criteria, and to assign point values to each, with the larger numbers going to the most important criteria. Here, however, the students balked. They felt that what they had created showed "the essential criteria," as Sandy put it, and that each criterion was equally important. Therefore, in this original rubric, the students simply assigned point values of "one" for each descriptor. A careful study of the original rubrics listed in Appendix A will show that this trend continued until design Product Eight, the rubric for alternative solutions. Here, students first differentiated importance of criteria by assigning different point values and then continued to do so for all the remaining original rubrics of the design products.

Second Thoughts: The Critiquing Guide for the Problem-Based Learning Curriculum Units

As the class progressed, rubrics for all eleven design products were constructed. Then, the masters-level students used the rubrics as guides and actually created each of the eleven products for their own PBL curriculum units. One enticement (other than the grade for the course!) for teachers to finish and submit all their products was the promise that completed units would be published on the Internet on a problem-based learning web-site developed by the instructor of the course. The instructor explained that she hoped the web-site would grow to include curriculum units for all disciplines, at all levels of instruction. However, she was afraid this would be a slow process, as the PBL course was only scheduled to be taught every two years. The teachers within the course suggested soliciting units from the general population of teachers, rather than limiting authorship to only those teachers enrolled in the PBL class. When the instructor expressed doubts about the quality of such submissions, the idea of the Critiquing Guide was born. The teachers within the class felt that such a Guide could be published on the web-site and could serve as an educative tool for anyone wishing to create a PBL unit. The Guide would also define the expected quality levels of submissions.

When this subject was originally broached, the first suggestion was simply to publish the rubrics for each of the design products. However, this idea was soon

discarded for three reasons. The first reason, stated by Joyce, was that "point scores are really irrelevant. We're not looking to give the teachers [who submit units] a grade. We just want the units to be complete and to contain the essential criteria." The second reason the original rubrics were not used for the Critiquing Guide was articulated by Jessica. "We've had this class, and we've read at least two books on the subject of PBL. But, the teachers who wish to submit may be as ignorant as we were before this class! I don't think our descriptions are clear enough for someone NOT in this class to understand the expectations." One other point made by the students was that designers of PBL units who had never taken this class might not clearly perceive the delineations between design products. For example, it was suggested by Eva that "they might lump together the curriculum alignment and the problem map."

Considering all these parameters led students to believe that the construction of a Critiquing Guide was the path they would like to take, rather than using the original rubrics. In a class discussion, the students decided the Guide would have three levels for feedback purposes: "Commendable," "Acceptable," and "Acceptable with Changes." As Candy put it, "This sounds better than 'Commendable,' 'Acceptable,' and 'Rejected.' We still get to reject any unit which doesn't conform to our quality criteria, but we do it in such a way that the author COULD re-submit and get published on the web, if they wanted to and if they made the necessary changes."

Working with these categories and working from the original rubrics, the students broke into groups of two to three. Each group then tackled at least two design products, writing quality descriptors for these products at the three different levels (Commendable, Acceptable, and Acceptable with Changes). Care was taken to explain terms and to make the criteria as explicit as possible.

Once one group had completed its task, the newly created Guide for that group's product was critiqued by another group. In this process, the groups found that many criteria overlapped from one design product to another. For example, the group working on the meet the problem document had included a descriptor addressing student roles. The group working on the sample problem statement had included a very similar descriptor, as had the group working on the problem map. The following classroom conversation shows how the students resolved this issue:

> Laura: We've [pointing to the three groups] all got essentially the same descriptor, even though we're working on three different products.
> Instructor: Do you see this a problem? Should we decide where the descriptor best fits?
> Laura: Well, we surely don't need to repeat the same thing three times. This Guide is going to be long enough as it is!
> Bridgette: Why don't we just write the descriptor once, but group the products together?
> Instructor: I don't get it. Help me understand what you're suggesting.
> Bridgette [at board] Well, we all have this part about student roles. So, over here, we just write [See Bridgette's graphic below.]

Product	Commendable	Acceptable	Acceptable with Changes
Meet the problem Sample statement Problem map	Student roles…		

This template, first proposed by Bridgette, was utilized for all the remaining descriptors which overlapped two or more design products. In this manner, through a jigsaw process (one group passing their work on to another group), the entire Critiquing Guide was constructed.

As each piece of the Critiquing Guide was created, the instructor typed and distributed this piece to students. When all groups had contributed pieces, the Guide was altered and refined through a group discussion process. Students then field-tested the refined Guide, using it to critique another student's PBL curriculum unit. After this activity, the class members pronounced themselves "happy" with the Guide as written (See Appendix B for the completed Critiquing Guide.), but listed a few constructive criticisms the instructor might wish to address in future iterations. These included:

- There is no place for an "overall" assessment of the submitted unit
- Motivation and interest to students has been overlooked
- "Life skills" (Appendix B, page 29) need to be defined as concepts outside the discipline of the class (as communication or interpersonal skills
- Strike the word "Abundant" (Appendix B, page 28) and substitute "Sufficient" but add the following to the statement: "*Sufficient* resources are available for students to successfully solve the problem *and resources encourage students to investigate other areas of the problem.*"
- It sounds as if each problem must allow a variety of capstone performances (Appendix B, page 29). Make it apparent that variety can be addressed by utilizing multiple problems. (It may be too much to expect a teacher to create multiple grading rubrics for diverse capstone performances in EVERY problem. However, the teacher can vary the type of capstone performance required from problem to problem.)

The instructor agreed to address these concerns before publishing the Critiquing Guide on the problem-based learning web-site.

Conclusions

Level One Findings

Findings from this research study include the "quality" criteria incorporated into the original rubrics for all eleven design products. These rubrics, found in Appendix A, document the relative importance of traits recommended for inclusion in the eleven design products by these novice PBL curriculum designers. The list of design products constitutes another finding of the study. While the majority of the design products were suggested by the instructor, two new products were created based upon recommendations from individual students. Although the students in the class were new to PBL, they were still veteran teachers. Therefore, the newly suggested products (Curriculum Alignment

and Resource List) arose from the prior knowledge gained by these veteran teachers from past teaching experiences.

Another finding of the study involves teacher attitudes about problem-based learning. Even though the masters-level students first expressed feelings of nervousness and insecurity in designing problem-based learning curriculum units, and even though they found some of the products difficult to design, they still expressed confidence that teachers who had never taken the PBL class could create quality PBL units. A collateral finding, however, was that the students felt such inexperienced designers would need clearly written guidelines to help them incorporate the desired level of quality into their designs. This led to another study product, the Critiquing Guide (Appendix B) for use by those novice PBL designers who had received no other training or support.

In the creation of this Critiquing Guide, the masters-level students gained a "big picture" view of the design process for the entire PBL curriculum unit. Previous to this exercise, students had worked on the unit in a piece-meal fashion, creating one design product at the time. However, when work began on the Critiquing Guide, the students' view changed from looking at one small piece to examining the larger work, *in toto*. When this perspective changed, they found that many of the criteria they had designed for individual pieces of the project were applicable to several design products. In this manner, students in the class moved from listing particular traits necessary in individual products to articulating essential traits of the entire unit. Therefore, the Critiquing Guide devised by the class does not attempt to show what each individual design product must include. Rather, it sets a standard of quality for the whole curriculum unit.

Level Two Findings

The above findings can be clearly tracked through the data reported in this paper and sometimes even traced to particular quotes from individual students. However, a second set of findings is not so readily apparent. These findings involve the utilization of rubrics in the PBL class and the change in teacher attitudes, thinking, and behavior as a result of this rubric use.

For some of the students, this class was their first introduction to rubric design. Bonnie stated in a reflective journal entry, "I had never seen or used a rubric until this class." Both Lois and John had heard of rubrics, or seen their use, but neither had ever participated in designing one. Lois stated this as, "I've never been asked to help create a rubric in which my work was to be evaluated." John made the following observations of the rubric design process:

> I was truly impressed with the method in which the class determined the rubric for our Meet the Problem document. The instructor did something I have rarely seen done on any academic level: allow the class to decide the method for scoring the assignment. I recognize the seasoned teacher in our instructor, as a set of predetermined guidelines were on display as we worked on our own rubric. And there was also some very subtle, yet effective "steering" going on. On the whole, however, the class decided what aspects of the document are to be graded and the point values of those parts.

Even those students who had previous experiences in rubric design, however, gained new insights in to the importance of rubrics within the PBL curriculum unit. Bonnie summed this up for the class as:

> With each day, the need and intent of rubrics becomes more apparent. Today's discussion on rubric development gave me a chance to propose ideas and get class feedback as well as the instructor's. It was an opportunity to use a sounding board for some of my ideas I would like to use in my assignments and class exercises…The combination of creating our own rubrics and to turn around and apply the information made some concepts a lot easier.

Thus, Bonnie saw personal benefits from the rubric design process. Joyce echoed Bonnie's comments, stating "I am so glad to have an objective tool, such as the rubric, to use. It seems like a lot of time to write out student expected outcomes, but I think it will help the students to know how they will be graded and what the expectations are."

Jessica, like Joyce, related the use of rubrics to her own students and expanded on this topic with: "Teachers need to provide good feedback and give the students rubrics to show what they are looking for…It is only fair that students get rubrics before doing the work. It is not fair for teachers to make up rubrics after the work is complete." John and Laura reiterated the importance of using rubrics to convey teacher expectations to students, and Laura reminded the class that "it is important to remember that the product I receive will only be as good as the rubric that I provide for my students."

So, while several of the masters-level students emphasized the importance of rubric utilization, few thought rubrics were easy to design. Again and again in reflective journals, this theme was reiterated and the following comments appeared:

> Laura: Writing a rubric is a very difficult process because it is hard to know what to include and how detailed to be.
>
> Anna: Writing detailed rubrics is difficulty as it forces me to examine exactly what I am interested I concerning the final product.
>
> Jessica: Today we went over how to make a rubric. It was very hard. It is difficult to identify what you are looking for in a project. You must do this before you can start making a rubric. Then you have to decide how important each item that you are looking for is and give it a number value. I never realized how hard that could be.

As these comments demonstrate, the novice designers found it difficult to clearly define their expectations. Anna summarized this sentiment as "Describing quality is like describing the color green."

Although the students thought the process of rubric design was difficult, most (11 out of 17) made some reference to implementing, continuing, or revising the use of rubrics in their own classrooms. Sandy decided, "In the future, I'll make a point of designing our rubrics together so they meet our needs and are comprehensible to the kids." Comprehension was also important to Anna who remarked, "Having felt first hand the relief of being graded by a comprehensible rubric when faced by an unknown teacher, I will endeavor to re-create that relief for my students."

From these additional data, then, it is clear that within this masters-level class

- Some of the students had limited or no prior knowledge of rubric utilization
- Many students articulated the importance of using rubrics, citing such reasons as quality, fairness to students, and aligning curriculum standards to assessment
- A majority of the students planned revision of their assessment methods, based upon their newly gained knowledge of rubrics.

Educational Significance of the Study

As problem-based learning gains in popularity and is implemented in classrooms throughout the nation, attention must turn to creating quality PBL experiences for students. This study utilized a diverse focus group, recruiting stakeholders from academic and vocational disciplines, to set criteria for judging PBL curriculum units. Within this process, knowledge essential to development of a quality product was identified and impediments to the design process were articulated. The Critiquing Guide created by the focus group can serve as a educative tool for other novice designers and aid these novices in constructing rich problem-based learning units of study for their students.

REFERENCES

Bridges, E. M. & Hallinger, P. (1995). Implementing problem based learning in leadership development. Eugene, OR: ERIC Clearinghouse on Educational Management, University of Oregon.

Denzin, N. K. & Lincoln, Y. S. (1994). Introduction: Entering the field of qualitative research. In N.K. Denzin & Y.S. Lincoln (Eds.), Handbook of qualitative research (pp. 1-17). Thousand Oaks, CA: Sage Publications, Inc.

Guba, E. G., & Lincoln, Y. S. (1989). Fourth generation evaluation. Newbury Park, CA: Sage Publications, Inc.

Guerrera, C. P., Lajoie, S.P. (1998). Investigating student interactions within a problem-based learning environment in biology. San Diego, CA: American Educational Research Association. (ERIC Document Reproduction Service No. ED 419 819)

Hmelo, C. (1998). Problem-based Learning: Effects on the early acquisition of cognitive skill in medicine. Journal of the Learning Sciences, 7(2), 173-208.

Rundquist, I., Bergdahl, B., Sandstrom, I., Hammar, M. (1998). A point system for management of an integrated problem-based learning curriculum. Education for Health: Change in Training and Practice, 11 (1), 7-14.

Shelton, J. B. & Smith, R. F. (1998). Problem-based learning in analytical science undergraduate teaching. Research in Science and Technological Education, 16 (2), 19-29.

Stewart, J. B. (1998). Problem-based learning in counselor education. Canadian Journal of Counseling, 32(1), 37-49.

Tobin, K., Kahle, J. B., & Fraser, B. J. (1990). Windows into science classrooms. Bristol, PA: The Falmer Press.

Torp, L. & Sage, S. (1998). Problems as possibilities: Problem-based learning for K-12 education. Alexandria, VA: Association for Supervision and Curriculum Development.

Von Glaserfeld, E. (1991). Answers to Atlanta (NARST) and Washington (AAAS) questions. Symposium conducted at the annual meeting of the National Association of Research in Science Teaching, Atlanta, GA.

Appendix A
Original Rubrics for All Nine Design Products

Product One: Rubric for Meet-the-Problem Document

Criteria	Descriptor	Points
Format	Authentic style, appropriate to problem, uses standard writing practices	_____ (3)
Motivational	Contains 2 or more of the following characteristics: discrepant event, novelty, relevance to real world	_____(2)
Problem Characteristics	Reality-based, no one right answer, interdisciplinary, contains deadline, lacks obvious solution path, contains focal points for knowledge acquisition	_____(6)
Student Roles	Present, role is one of stakeholder who in real world would work on problem	_____(2)

TOTAL POINTS _____ (13)

Product Two: Rubric for Curriculum Alignment

Criteria	Descriptor	Points
Objectives	3 from major area, 3 from interdisciplinary area	_____ (6)
Student Characteristics	5 significant learner characteristics listed	_____ (5)

TOTAL _____ (11)

Product Three: Rubric for Sample Know/Need to Know Boards

Name_____ Date_____

Criteria	Descriptor	Points
Knows	Need minimum of 10	_____ (10)
Need to Knows	Need minimum of 7	_____ (7)
	TOTAL	_____ (17)

Product Four: Rubric for Sample Problem Statement

_____Role Stated (1 pt)

_____Problem Stated (1pt)

_____4 Conditions Stated (4 pts)

Total Points _____(6 pts)

Product Five: Rubric for Problem Map

_____ Contains 1 central idea (1pt)

_____Contains 4 extensions (4 pts.)

_____Each extension contains 2 sub-extensions (8 pts.)

Total Points_____ (13 pts.)

Product Six: Rubric for Coaching Questions

One Cognition (Thinking) Question To Ask Students Written for Each of the Following Activities:

Meet the Problem	_____ (1 pt)
Know/Need to Know Board	_____ (1 pt)
Writing the Problem Statement	_____ (1 pt)
Information Gathering & Sharing (Research)	_____ (1 pt)
Generating Possible Solutions	_____ (1 pt)

One Metacognition (Learning About Thinking) Question To Ask Students Written for Each of the Following Activities:

Meet the Problem	_____ (1 pt)
Know/Need to Know Board	_____ (1 pt)
Writing the Problem Statement	_____ (1 pt)
Information Gathering & Sharing (Research)	_____ (1 pt)
Generating Possible Solutions	_____ (1 pt)

One Epistemic Cognition (Nature of Knowing) Question To Ask Students Written for Each of the Following Activities:

Meet the Problem	_____ (1 pt)
Know/Need to Know Board	_____ (1 pt)
Writing the Problem Statement	_____ (1 pt)
Information Gathering & Sharing (Research)	_____ (1 pt)
Generating Possible Solutions	_____ (1 pt)

TOTAL POINTS _____ (15 pts)

Cognitive: Students compute, read, perceive, and comprehend information. *According to the meet the problem document, what is your role in this problem?*

Metacognitive: These questions help students monitor their own thinking process and consider appropriate strategies. *if you are having difficulty locating resources for the research on "conjoined twins," what alternative terms might you try?*

Epistemic: Refers to the individual's understanding of the nature of problems and includes knowledge about the limits and certainty of knowing,

and the criteria for knowing. *Is it necessary to find answers to ALL your Need to Know questions?*

Product Seven: Rubric for Resource List

Number of Resources (8 required) _____(8)

Use of APA Style in each listing _____(8)

Use of 4 different types of source material _____(4)

TOTAL POINTS _____(20)

Product Eight: Rubric for Alternative Solutions

Two possible solutions to problem described _____(20)

4 "pro" statements listed for each possible solution _____(8)

4 "con" statements listed for each possible solution _____(8)

2 consequences listed for each possible solution _____(4)

1 paragraph written, stating preferred solution and describing rationale for choosing this one over the other _____(10)

Total Points _____(50)

Product Nine: Capstone Performance Description	
Is authentic to problem	_____(15)
Relates to stated objectives	_____(10)
Promotes learning of new or refinement of old skills/knowledge	_____(8)
Addresses at least 2 types of assessment (group, peer, self)	_____(6)
States audience for performance	_____(4)
Describes what students will do to share solution to problem	_____(15)
Total Points _____(58)	

Product Ten: Rubric for Assessment Instrument	
Contains at least 4 criteria	_____(20)
Each criterion has two descriptors	_____(8)
First descriptor details excellence	_____(4)
Second descriptor details mediocre (not worst) performance	_____(4)
Total Points _____(36)	

Product Eleven: Rubric for Debriefing Session

Review of Student-Generated Solutions

Description of the procedure for disseminating solutions is included and the procedure ensures that all student solutions will be shared with all students. 10 pts.

A description is present, but no mention of all solutions being shared with all students. 5 pts.

Rating of Solutions

A clear description of the procedure for rating all solutions is present (description gives examples of procedure, as using pro and con graphic organizers). The procedure for sharing the ratings is also clearly described. 20 pts.

Procedures for rating and procedures for sharing ratings are described, but lack of clarity impedes complete understanding. 15 pts.

One Best Solution

Description of a process which leads students to formulate one "best" solution from all student-generated solutions and from any new issues which arose during the discussion of these is present. 30 pts.

Coaching by Teacher

Explanation of debriefing process explains how the teacher will coach students through this process in order to address important concepts/issues that did not arise during investigation of the problem. 20 pts.

Total Points Possible = 80

Products to Examine	Commendable	Acceptab
Meet the Problem Curriculum Alignment Sample Problem Statement Sample Know/Need to Know Boards Problem Map	Student roles are authentic to problem	Student rol to problem
	Multiple student roles present	One or mor roles presen
	Problem is ill-structured in that it activates students' prior knowledge but requires research (No known solution or solution path. Problem is solvable to students within the time allotted	Problem ma slightly too too narrow, by students time allotte known solu solution pat
	Problem is high impact (impacts large population AND/OR of high importance to locale) and is motivating to students	Problem is interest to s although no impact
	Authentic format used for presenting problem to students	Format is re not outstan authentic to

ndix B
n Based Learning Curriculum Unit

le	**Acceptable with Changes**
es are central	Student role is peripheral to problem
e student t	Student role unclear or relevance to problem not established
ay be too complex or but solvable within the d. (No tion or h.)	Problem is so narrow students are led to one solution path OR problem is so broad, students cannot determine problem focus OR there is no need to solve the problem, as a solution exists in the public domain.
of high tudents, ot of high	Problem is low impact, low interest
ealistic, but dingly problem	Format is unrealistic, contrived, not authentic to problem

Products to Examine	Commendable	Acceptabl
Meet the Problem Curriculum Alignment Sample Problem Statement Sample Know/Need to Know Boards Problem Map	Problem is developmentally appropriate for target student population	Problem is developmen appropriate f student popu
	Problem contains 2 of 3 motivating factors: novelty, discrepant event, or high relevance to the real world	Problem con motivating fa novelty, disc event, or hig to the real w
	Problem is interdisciplinary in 3 or more areas	Problem is interdisciplir more areas
	Problem promotes acquisition of skills/knowledge found in national standards as well as state, district, and school standards	Problem pro acquisition o district, and standards

e	Acceptable with Changes
ally or target lation	Problem may cause academic "stretching," but students can be successful with support from teacher
tains 2 of 3 actors: repant h relevance orld	Problem has only one of the three factors
ary in 2-or	Problem is not interdisciplinary as written
motes f state, school	Problem is not aligned to national or local standards

6

Products to Examine	Commendable	Acce
Meet the Problem Curriculum Alignment Sample Problem Statement Sample Know/Need to Know Boards Problem Map	Problem includes materials not normally studied in this class if such material helps students build important life skills (communication, interpersonal skills)	Problem pri emphasizes based skills attention to
	Problem activities are suitable for a variety of student learning styles	Problem ac diverse, but suitable for number of l styles
	Problem contains a range of activities so students of different achievement levels can contribute	Problem ac to be either low end, bu is apparent

ptable	Acceptable with Changes
marily school-, with some life skills	Problem exclusively emphasizes school-based skills
tivities are tend to be a limited earning	Problem activities are suitable to only one learning styles
tivities tend high end or t some range	No diverse levels of achievement are present within problem activities

Products to Examine	Commendable	Acceptable
Resource List Curriculum Alignment	List contains a mix of print resources (books, journals), non-print (videos, films)and Internet resources available in classroom, school, and larger community. Four or more different types of resources is present	List contains at of the resource categories (prir print, and Inter available from classroom, sch larger commun
	Resources on list are developmentally appropriate for target student population	Some resource may be slightly slightly below mental age of t student popula
	List contains at least 4 different types of resources (Ex: book, journal, encyclopedia, film, Internet)	List contains re of at least 3 dif types
	Sufficient resources are available for students to successfully solve the problem and resources encourage students to investigate other areas of the problem	Sufficient reso available to all students to suc solve the probl

	Acceptable with Changes
least two t, non- net) ool and ity	List contains resources from only one category AND/OR concentrates only on classroom and school resources
levels above or develop- he target ion	Most resources are developmentally inappropriate for target student population
sources ferent	List contains only 1 or 2 different types of resources
urces are ow cessfully em	Resources are insufficient to allow students to successfully solve the problem.

Products to Examine	Commendable	Acceptable
Capstone Performance Curriculum Alignment	Demonstrates mastery of curriculum content and skills	Demonstrates curriculum co skills
	Requires active participation by every student in the class	Requires cont every student
	Is authentic to problem	Is authentic to
	Promotes learning of most of the stated objectives	Promotes lear most of the st objectives
	Requires input from an audience of class members, teacher, and professionals in the field	Requires inpu audience cons class member teacher
	Student autonomy is encouraged, as students may choose from several different capstone performance formats (oral presentation, written report, drama)	Student auton encouraged, a may choose s different strat within the san capstone perf (Live skit, rec speech, re-ena

	Acceptable with Changes
mastery of ntent and	Is unclear how activity will demonstrate mastery of curriculum/skills
ribution by in the class	Some students have no input to capstone performance
problem	Activity does not provide exemplar of real-world work, suitable to problem
ning of ated	Provides little opportunity for promotion of learning objectives
t from an isting of s and	Teacher is the only appropriate audience
omy is s students everal egies ne ormance orded skit, ctment	Capstone performance is assigned by teacher, with no range of choices in strategies or format

Products to Examine	Commendable	Acceptable
Assessment Instrument Curriculum Alignment Capstone Performance	Utilizes a rubric containing at least 6 criteria, with 3 or more clearly written descriptors for each	Rubric utilizes criteria, with 2 clearly written descriptors for
	Criteria identify all components of exemplary work	Criteria identi majority of co of exemplary
	Criteria reflect alignment to all stated objectives	Criteria reflec alignment to n stated objectiv
	Point scores on rubric are adjusted to show relative importance of criteria	Point scores o are adjusted to relative impor criteria
	Score conversion scale is provided	Score convers is provided
	Rubric provides substantial feedback for performance improvement, utilizing analytical scoring	Rubric provid adequate feedb performance improvement, analytical scor

	Acceptable with Changes
at least 4 or more each	Rubric utilizes less than 4 criteria AND/OR descriptors are unclear
y the mponents work	Criteria do not adequately identify components of exemplary work
ost of the es	Criteria reflect alignment to only a few of the stated objectives
n rubric show tance of	Point scores on rubric are misaligned with importance of criteria
ion scale	No score conversion scale present
es back for utilizing ing	Inadequate feedback for performance improvement is available OR holistic scoring is used

Products to Examine	Commendable	Acc
Assessment Instrument Curriculum Alignment Capstone Performance	Rubric uses clear language, easily understood by target student population	Rubric use language, understoo student po
	Rubric addresses self, peer, group, and teacher assessment	Rubric ad types of a

eptable	Acceptable with Changes
es clear easily d by target pulation	Language in rubric is ambiguous, unclear, or developmentally inappropriate
dresses only 3 ssessment	Rubric addresses only 1-2 types of assessment

Products to Examine	Commendable	Accepta
Coaching Questions Problem Map Sample Problem Statement Know/Need to Know Boards Alternative Solutions Web Profile Sheet	A minimum of 3 sample coaching questions for each category of the unit is present. The level of each question is designated.	A minimu coaching each categ is present
	Anticipated problem map contains at least 6 extensions from central idea, each with 3 sub-extensions	Anticipate contains a extensions idea, each extensions
	Sample problem statement states students roles, outlines problem, and gives a minimum of 4 conditions for solving	Sample pr states stud outlines p gives a mi conditions
	Know Board contains a minimum of 15 facts derived from the meet the problem document	Know boa minimum derived fr problem d

ble	Acceptable with Changes
m of 3 sample questions for gory of the unit	Less than 3 sample coaching questions for each category of the unit are present
d problem map t least 4 s from central with 2 sub- s	Problem map is present, but appears to be curriculum map rather than anticipated problem map OR map contains less than 4 extensions from central idea
oblem statement lent roles, roblems, and nimum of 3 s for solving	Sample problem statement does not use PBL format, with student roles OR problem outline OR 3 conditions are missing
rd contains a of 10 facts om the meet the ocument	Know board contains less than 10 facts OR facts do not appear to be derived from the meet the problem document

Products to Examine	Commendable	A
Coaching Questions Problem Map Sample Problem Statement Know/Need to Know Boards Alternative Solutions Web Profile Sheet	Need to Know Board contains a minimum of 7 questions	Need to contains question
	Two alternative solutions are clearly and completely explained, each with 4 pros, 4 cons, and 2 consequences	Two alte are prese pros, 4 c consequ
	Description of debriefing session includes clear procedures for review of student generated solutions, the rating of these solutions by students, the choice of one best, overall class solution, and coaching by the teacher during this session.	Descript session i procedur student g solutions these sol students, best, ove
	Web Profile sheet is complete	Web Pro complet

cceptable	Acceptable with Changes
Know Board a minimum of 5 s	Need to know board contains less than 5 questions
rnative solutions nt, each with 4 ons, and 2 ences	Only one possible solution to problem is articulated OR less than 4 pros, 4 cons, and 2 consequences are present
ion of debriefing ncludes clear es for review of generated , the rating of utions by the choice of one rall class solution	Description of debriefing session does not clearly outline procedures to be used for review of student-generated solutions, the rating of these solutions by students, and the choice of one best, overall class solution OR one or more procedures is missing
file sheet is e	Web Profile sheet is complete